

Vehicles Condition and Drivers' Perception of Road Accidents: Evidence from District Dir Lower, Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

This study examines the association between vehicle condition and drivers' perception of road accidents in District Dir Lower, Khyber Pakhtunkhwa, Pakistan. A random sample of 285 drivers was drawn from four major bus stands: Ahmad Brothers Coach Dir Flying Coach (ABC DFC), General Bus Stand, New Dir Flying Coach Company (NDFC) and Malak Bus Stand. A well designed structured interview schedule was used to collect primary data from the respondents at major bus stands. The study applied univariate analysis using descriptive statistics (frequencies and percentage distribution) and bivariate analysis for Chi Square test. The Chi square test was used to determine the association between the dependent variable (drivers' perception of road accidents) and the independent variable (vehicle condition). Association between vehicle condition and drivers perception of road accidents show that drivers perception of road accident had significant association ($P = 0.001$) with vehicles are often in poor condition, with issues like broken lights or worn-out tires, condition of vehicle impacts driving performance ($P = 0.005$), drivers regularly checked their vehicle's brakes, tires, and lights for safety ($P = 0.003$), and vehicle often experiences breakdowns or mechanical failures ($P = 0.000$). It is concluded from the study that in the public transport, especially those used for shorter distance, improperly maintained old model vehicles are used. Such vehicles are often in poor condition with issues like broken lights or worn out tire. Although, according to drivers, they regularly check their vehicles brakes, tire and lights for safety but drivers still experiences breakdown or mechanical failures, because they ignore minor problem like malfunctioning indicators, signals and breaks. Therefore, vehicle condition is highly associated with fatalities, injuries and financial loss due to road accidents. It is suggested to enact and effectively implement laws that restrict the use of poorly maintained or old vehicles for general public transport, and to mandate

regular mechanical inspections for all public and private vehicles through the establishment of a dedicated regulatory department.

Introduction

The condition of the vehicle, the road conditions, and any driver-related circumstances are all associated with traffic injuries (Peden et al., 2004, Ullah et al., 2025). Driving habits, drug usage while operating a motor vehicle, exhaustion, the driver's health, and other variables significantly impact the number of drivers involved in traffic accidents (Crouch et al., 1993; Odero, Garner & Zwi, 1997; Ullah et al., 2025). Vehicle features include traffic accidents brought on by a mechanical flaw and tire rupture. Engine failures, braking failures, and steering problems are all examples of mechanical fault (Factor et al., 2007). Drivers may lose control of their vehicles or force them to stop abruptly due to a stalled engine or a damaged transmission, putting other people at danger. Braking may become challenging or impossible if there is damage to the brake pads, lines, cylinders, or pedals, leading to an unavoidable collision (Factor et al., 2010). Furthermore, the driver might not be able to escape an accident if the power steering pump, hydraulic lines, tie rods, or another part of the steering and suspension system malfunctions. It is clear that a driver can lose control of their car if their tires are old, underinflated, unbalanced or incorrectly weighted, improperly mounted or positioned, or not appropriate for the vehicle (Hussain et al., 2021).

In Pakistan, commercial drivers and cars have a high incidence of these variables. When it comes to safe driving practices, such wearing seat belts, there is a low prevalence of poor vehicle maintenance. Essentials like seat belts and speedometers are missing from a sizable percentage of cars (Mir et al., 2013). Poor car conditions brought on by sporadic or insufficient maintenance might result in traffic accidents (Barengo, et al., 2006). Tires and car brakes are the most common mechanical flaws (Van Schoor et al., 2001; Rechnitzer et al., 2000).

Drivers involved in accidents report experiencing tire bursts, brake failures, or both in the car they used for work. Interestingly, those who drove on roads that needed repair seemed to be less likely to be involved in an accident than people who drove on roads that were in high condition. This inverse association could be explained by the connection between speeding and collisions. Speeding may be restricted by bad road conditions (Mir et al., 2013; Ullah et al., 2025; Factor et al., 2010).

Literature Review

Around the world, traffic accidents claim hundreds of lives and harm countless more each year. Although human error is frequently blamed for these collisions, car flaws have also been found to have a major role (Moodley & Allopi, 2008). Vehicle flaws can still cause serious collisions that result in injuries, fatalities, and significant property damage despite the use of cutting-edge safety devices and stringent restrictions. Vehicle defect-related collisions have been a recurring safety issue in the US for many years, with design defects, manufacturing mistakes, and poor maintenance resulting in a high number of incidents (Factor et al., 2010; Lemann, 2019).

Mechanical flaws in vehicles might be anything from small ones like worn-out brakes

and tires to serious structural faults (Singh & Santokh, 2015). It is estimated that about one in five US automobiles now on the road have an outstanding recall, which indicates that a known defective part or design is present (Astvansh et al., 2022). Vehicle flaws were determined to be 2% of the final failure in the causal chain of events leading to a crash out of 5470 crashes studied by the National Motor Vehicle Crash Causation Survey (NMVCCS), which was carried out between 2005 and 2007. About 35% of the 2% of collisions linked to vehicle flaws involved tire issues, 22% involved brake issues, and 43% involved other components (Singh & Santokh, 2015). Understanding the effects of car faults on road safety and identifying ways to reduce the likelihood of these occurrences are vital given the growing number of older vehicles and the large number of faulty vehicles still being driven on US roads. This is especially crucial given the development of autonomous vehicles, which could cause road safety issues to move from driver-related issues to vehicle-related issues and overall system failures (Adanu et al., 2024).

Prior studies have mostly blamed human error for auto accidents (Iden, et al., 2006; Varmazyar et al., 2013). In the landmark investigation of the tri-level causes of traffic accidents (Treat et al., 1979) environmental variables were recognized as the probable cause in 33.8% of the collisions that were studied, human factors in 92.6% of the crashes, and vehicle factors in 12.6% of the crashes. Brake failure, inadequate tread depth, side-to-side brake imbalance, under-inflation, and vehicle-related visibility impairments were the study's main vehicle causes. The National Highway Traffic Safety Administration found 15 safety issues during car inspections in another investigation, and one of those issues was vehicle faults (Green et al., 2017).

Vehicle flaws are more technical in origin and may be fixed directly, in contrast to human error (Solah et al., 2017). Even though most car flaws may be fixed, a number of variables, including financial constraints, affect a driver's or owner's ability to take care of these problems for example Ozelim et al. (2016) found that drivers' socioeconomic position and the ownership of faulty automobiles were significantly correlated. This emphasizes how crucial it is to handle road safety issues pertaining to vehicle flaws from a human-centered perspective. It is imperative that appropriate countermeasures be put in place that target drivers and car owners who own faulty automobiles. The precise identification of these drivers' regional distribution is essential to the success of various initiatives, such as education and awareness campaigns (Singh & Santokh, 2015). Drivers are more likely to own vehicles with open recalls in the southern US. According to their research, the highest open recall percentage is found in southern states like Alabama. Therefore, inhabitants of these states can be the right target of efforts to address the problem of defective vehicles and road protection (Factor, 2010).

Few studies have been done to examine how vehicle flaws contribute to crash occurrence and outcomes, in contrast to crash studies that mostly concentrate on human variables. One such earlier study looked into 502 crashes involving buses and commercial vehicles in South Africa "on the spot"(Kinsey, 1976). The study's findings showed that 9% of collisions were caused by car flaws. Another study looked into how mechanical breakdowns affected car crashes in the South African city of Pretoria (Van Schoor et al., 2001). Tires and brakes were the main causes of mechanical problems that resulted to crashes, according to study data from the crash

response unit (ARU). Subsequent investigation employing roadside surveys (possible mechanical defect tests) revealed that 29% of vehicles tested on the highway and 40% of vehicles surveyed on suburban roads had mechanical flaws that could have contributed to a collision due to a mechanical failure. Minibus surveys revealed that tire inflation pressure was a problem. The majority of recent research also showed that the most frequent car flaws that cause collisions are mechanical problems (Conroy, et al., 2008; Hoque, et al., 2006).

The vehicle parts that are most frequently engaged in incidents including defects, the main causes of traffic accidents are tire, running gear, and brake system flaws (Haq et al., 2020). The study also showed that poor maintenance and servicing made older cars more likely to crash, which is in line with other studies' findings (Akloweg et al., 2011; Das et al., 2021). Another study analyzed the major vehicle faults that contribute to road crashes using data gained from examining private passenger vehicles and concluded that the two most common vehicle defects connected with private passenger vehicles were worn out tires and structural integrity (Solah, et al., 2017). The study also discovered that automobiles submitted for voluntary inspections have a higher risk of failing than vehicles sent for normal inspections. Using 7 years of crash data (2010–2016) from Louisiana also found that faulty brakes and worn tires were overrepresented in collisions linked to vehicle defects (Das et al., 2021).

According to Haq et al. (2020) some researchers also looked into the factors that contribute to those failures. Using ten years (2007–2016) of historical crash data along I-80 in Wyoming, the study found that the following factors are associated with higher tire failure occurrences: vehicle speeds exceeding 75 mph, commercial motor vehicles, summer, daytime, the presence of rough surface, downgrades, and concrete pavement. Additionally, tire failure in combination with fire or explosion, rollover, guardrail hits, ran-off road, angle, rear-end, clear weather, speeding, downgrades, and curved segments were found to be linked to serious injuries.

Another study used crash data from Wyoming to examine the factors that influence brake failure and the injuries that result from it. Brake failures were shown to be more common in trucks, downhill slope segments, and older cars (>15 years) (Haq et al., 2023). More serious injuries are caused by brake failure-related collisions involving vehicles older than 15 years, trucks, SUVs, and pickups, female drivers, and airbag activation (Haq et al., 2020).

The degree to which different flaws contribute to crashes and crash outcomes must be determined in order to prioritize the adoption of crash countermeasures related to vehicle problems. Usually, a statistical or mathematical analytical instrument is used in this process. A variety of techniques have been employed in earlier research to examine the variables linked to car flaws. Among the techniques employed is logistic regression (Solah, et al., 2017).

Although prior research has successfully identified factors linked to a variety of vehicle defects, injury-severity analysis can result in biased parameter estimates and possibly incorrect decisions and countermeasures if unobserved heterogeneity in crash data is not taken into account (Mannering et al., 2016).

Materials and Methods

The study was conducted in **Dir (Lower)** focusing on drivers from four bus stands: Malak Bus Stand, General Bus Stand, New Dir Flying Coach Company (NDFC) and Ahmad Brothers Coach Dir Flying Coach (ABC DFC). A pilot survey estimated **1,047 drivers**, from which a **sample of 285** was selected proportionally (Sekaran, 2003). **Vehicle condition** was treated as the independent variable and **drivers' perception of road accidents** as the dependent variable. Primary data were collected through **structured interviews** due to prevalent illiteracy. Data were coded and analyzed using **SPSS**, with univariate analysis reporting frequencies and percentages, and bivariate analysis using the **chi-square test** to examine associations.

Results and Discussion

Respondent's perception regarding vehicle condition

Vehicle condition play a crucial role in road accidents. the high number of outdated and defective cars are still in use, which increases the risk of mechanical failure and traffic accidents. Vehicle flaws such as inadequate maintenance, blown tires, and broken brakes and many other defects play a significant part in collisions. Perception regarding vehicle condition is given in table 1.

The results reveals that the majority 90.2% of the respondents regularly maintained their vehicle to ensure its good condition. Similarly, 60.7% agreed that their vehicle was often in poor condition, with issues like broken lights or worn-out tires and 89.8% feel that their vehicles condition effected their driving performance. Majority of drivers regularly maintained their vehicle to ensure its in good position. While their vehicle was often in poor condition with issues like broken lights or worn out tires and their vehicle condition effect driving performance and can loss the control on their vehicle. That's results traffic accidents and enhance the chances of injuries, human loss and financial loss. Poor vehicle conditions caused by irregular or inadequate maintenance could lead to collisions (Barengo, et al., 2006). Car brakes and tires are the most frequent mechanical problems (Van Schoor et al., 2001; Rechnitzer et al., 2000). It is evident that tires that are outdated, underinflated, imbalanced or wrongly weighted, mounted or positioned inappropriately, or inappropriate for the vehicle can cause a driver to lose control of their vehicle (Hussain, Shi, and Baikejuli, 2021).

Moreover 67.0% of the respondents ignored minor vehicle problems, such as malfunctioning, signals or brakes, 88.1% regularly checked their vehicles breaks, tire and lights for the safety, 86.7% experienced breakdown or mechanical failures in their vehicles, and 81.8% felt that the age of their vehicles affected its reliability on the road. Mostly respondents regularly checked their vehicle breaks, tire and lights for the safety but majority of respondents also ignore miner vehicle problems, such as malfunctioning, signals or breaks. Similarly, majority of drivers experienced breakdown or mechanical failures in their vehicles. They feel that the age of their vehicles affected its reliability on the road. Old vehicles combined with driver's ignorance of minor problem such as malfunctioning, signals and break are linked with road accidents. Tire, running gear, and brake system problems are the most often involved vehicle parts in instances involving defects, which are the primary causes of traffic accidents (Haq et al., 2020). The study also found that inadequate maintenance

and servicing rendered older automobiles more likely to crash, which is consistent with other studies' findings (Akloweg, et al., 2011 and Das, et al., 2021). Another study examined crash data from Wyoming to determine the elements that impact brake failure and the injuries that occur from it. Brake failures were shown to be more likely in trucks, downhill slope segments, and older vehicles (>15 years). Brake failure-related collisions involving vehicles older than 15 years, trucks, SUVs and pickups, female drivers, and airbag activation result in more serious injuries (Haq, et al., 2020).

Thus many drivers claim to frequently maintain their vehicles, the presence of common problems such as broken lights, worn-out tires, and malfunctioning brakes proves a gap between perceived and real vehicle care. This carelessness, particularly in the case of minor but crucial faults, has a significant impact on driving performance and raises the likelihood of traffic accidents, injuries, and financial losses. Furthermore, the age of a vehicle has a significant impact on its reliability, with older vehicles being more vulnerable to mechanical breakdown. These factors poor maintenance, ignored minor problems, and elder vehicles are all closely related to the occurrence of road accidents.

Table 1. Respondents Perception regarding vehicle condition

Statement	Agree	Uncertain	Disagree
I regularly maintain my vehicle to ensure it's in good condition.	257(90.2%)	14(4.9%)	14(4.9%)
My vehicle is often in poor condition, with issues like broken lights or worn-out tires.	173(60.7%)	26(9.1%)	86(30.2%)
I feel that the condition of my vehicle impacts my driving performance.	256(89.8%)	8(2.8%)	21(7.4%)
I ignore minor vehicle problems, such as malfunctioning signals or brakes.	191(67.0%)	22(7.7%)	72(25.3%)
I regularly check my vehicle's brakes, tires, and lights for safety.	251(88.1%)	9(3.2%)	25(8.8%)
My vehicle often experiences breakdowns or mechanical failures.	247(86.7%)	19(6.7%)	19(6.7%)
I feel that the age of my vehicle affects its reliability on the road.	233(81.8%)	15(5.3%)	37(13.0%)

Source: Field survey 2025

Association between vehicle condition and Drivers perception of road accidents

The condition of a vehicle has a significant impact on public perception and actual danger of traffic accidents. Well-kept vehicles are frequently linked with safety and dependability, whereas badly maintained vehicles may be perceived as hazardous and more prone to mechanical problems that can lead to accidents. The association of vehicle condition and Drivers perception of road accident is showed in table 4.

A significant association ($P = 0.001$) was found between drivers' perception of road accident and that vehicles are often in poor condition, with issues like broken lights or worn-out tires. Likewise, a significant association ($P = 0.005$) was found between drivers' perception of road accident and the condition of vehicle impacts driving performance. Additionally, significant association ($P = 0.003$) was found between Drivers perception of road accident and drivers regularly checked their vehicle's brakes, tires, and lights for safety. Similarly, highly significant association ($P = 0.000$) was found between drivers perception of road accident and vehicle often experiences breakdowns or mechanical failures. Drivers regularly checked their vehicles to insure its safety but due to poor vehicle condition drivers experience mechanical failures. Issues such as broken lights, worn-out tires and breaks failure affect drivers driving performance and proper functioning of the vehicle. Consequently, increasing the chances of serious accidents and its associated fatalities, injuries and financial loss. traffic accidents claim hundreds of lives and harm countless more each year. Although human error is frequently blamed for these collisions, car flaws have also been found to have a major role (Moodley and Allopi 2008). Vehicle flaws can still cause serious accidents that result in injuries, fatalities, and significant property damage despite the use of cutting-edge safety devices and stringent restrictions. Vehicle defect-related collisions have been a recurring safety issue in the US for many years, with design defects, manufacturing mistakes, and poor maintenance resulting in a high number of incidents (Lemann, 2019). Similarly, Singh and Santokh, (2015) also found that Mechanical flaws in vehicles might be anything from small ones like worn-out brakes and tires to serious structural faults. Moreover, the vehicle parts that are most frequently engaged in incidents including defects, the main causes of traffic accidents are tire, running gear, and brake system flaws (Haq et al., 2020).

Conversely, a non-significant association ($P = 0.970$) was found between drivers perception of road accident and regularly maintaining vehicle to ensure its in good position. Moreover, non-significant association ($P = 0.575$) was found between drivers perception of road accident and ignoring minor vehicle problems, such as malfunctioning signals or brakes. In addition, non-significant association ($P = 0.317$) was found between drivers perception of road accident and age of vehicle affects its reliability on the road.

Therefore, Poor vehicle condition and mechanical flues such as worn-out tires, light faults and break failure which effect driving performance have major role in road accidents which escalate the probability of injuries, fatalities and financial loss.

Table 2. Association between vehicle condition and Drivers perception of road accidents

Statements	Drivers Perception of road accident				Total	Chi-Square p=Value
	Level	High risk road accident	Moderate road accident	Low risk road accident		
I regularly	Agree		89(34.6%)	49(19.1%)	257(100%)	$\chi^2=$

maintain my vehicle to ensure it's in good condition.		119(46.3%)				0.531
	Uncertain	6(42.9%)	6(42.9%)	2(14.3%)	14(100%)	P =0.970
	Disagree	6(42.9%)	5(35.7%)	3(21.4%)	14(100%)	
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	
My vehicle is often in poor condition, with issues like broken lights or worn-out tires.	Agree	85(49.1%)	69(39.9%)	19(11%)	173(100%)	$\chi^2=$
	Uncertain	11(42.3%)	8(30.8%)	7(26.9%)	26(100%)	19.025
	Disagree	35(40.7%)	23(26.7%)	28(32.6%)	86(100%)	P = 0.001
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	
I feel that the condition of my vehicle impacts my driving performance.	Agree	127(49.6%)	85(33.2%)	44(17.2%)	256(100%)	$\chi^2=$
	Uncertain	2(25%)	4(50%)	2(25%)	8(100%)	14.764
	Disagree	2(9.5%)	11(52.4%)	8(38.1%)	21(100%)	P =0.005
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	
I ignore minor vehicle problems, such as malfunctioning signals or brakes.	Agree	91(47.6%)	67(35.1%)	33(17.3%)	191(100%)	$\chi^2=$
	Uncertain	8 (36.4%)	7(31.8%)	7(31.8%)	22(100%)	2.897
	Disagree	32 (44.4%)	26(36.1%)	14(19.4%)	72(100%)	P =0.575
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	
I regularly check my vehicle's brakes, tires, and lights for safety.	Agree	116 (46.2%)	88(35.1%)	47(18.7%)	251(100%)	$\chi^2=$
	Uncertain	0 (0%)	8(88.9%)	1(11.1%)	9(100%)	15.867
	Disagree	15(60%)	4(16%)	6(24%)	25(100%)	P =0.003
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	
My vehicle often experiences breakdowns or mechanical failures.	Agree	122(49.4%)	90(36.4%)	35(14.2%)	247(100%)	$\chi^2=$
	Uncertain	5 (26.3%)	10(52.6%)	4(21.1%)	19(100%)	52.374
	Disagree	4(21.1%)	0(0%)	15(78.9%)	19(100%)	P =0.000
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	
I feel that the age of my vehicle affects its reliability on the road.	Agree	112(48.1%)	80(34.3%)	41(17.6%)	233(100%)	$\chi^2=$
	Uncertain	4(26.7%)	8(53.3%)	3(20%)	15(100%)	4.720
	Disagree	15(40.5%)	12(32.4%)	10(27%)	37(100%)	P =0.317
	Total	131(46%)	100(35.1%)	54(18.9%)	285(100%)	

Conclusions and Recommendations

The study concluded that public transport vehicles, particularly those used for short distances, are often **old and poorly maintained**, with issues such as broken lights or worn-out tires. Although drivers report regularly checking brakes, tires, and lights, minor problems like malfunctioning signals and brakes are often ignored, leading to **mechanical failures**. Consequently, **vehicle condition is strongly associated with**

fatalities, injuries, and financial losses from road accidents. It is therefore recommended that laws be enacted and enforced to **restrict the use of old or poorly maintained vehicles** and to **mandate regular mechanical inspections** for all public and private vehicles through a dedicated regulatory department.

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